

Case No.: SMART-084B

TITLE OF THE INVENTION

**ANIMATION DEVICE FOR
HEAD, MOUTH, ARMS AND BODY OF A TOY**

INVENTOR

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CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a Continuation-In-Part of U.S. Application 10/127,241, filed on April 22, 2002, entitled "Animation Device for Head and Mouth of a Toy", the content of which is expressly incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates generally to animated figures, and more particularly, to a compact, inexpensive animation device for imparting realistic, life-like movements to the head, mouth, arms, and body of a figure or toy.

2. Background of the Invention

[0003] There have been known for many years various types of animated figures and toys which are capable of performing various movements in sequences and/or combinations so as to convey a life-like appearance. Such animated figures are often found in amusement parks, with more simplified animated toys being made available commercially in many toy stores or toy departments of various retail establishments. The animated figures often seen in amusement parks are generally of extremely complex construction, including many motors which facilitate the movements of various body parts of the figure (e.g., the head, eyes, mouth, arms, body, legs, etc.). The control of these numerous motors is typically facilitated by a central processor which is programmed to coordinate the actuation of the motors as needed to impart to the animated figure life-like movements. As will be recognized, these animated figures are highly sophisticated, expensive devices, typically unsuitable for the consumer market.

[0004] Those animated figures (e.g., toys) which are suited for the consumer markets are substantially less complex, and thus, substantially less expensive than the aforementioned "amusement park" animated figures. In this regard, animated figures that

are currently available, such as dolls and soft toy animals, are typically provided with one or more motors capable of facilitating a limited range of movement of one or more corresponding body parts of the figure. The animated figures which include a single motor to facilitate movement of a corresponding body part tend to be less expensive, but are extremely limited in their ability to provide life-like movements to the figure. Animated figures or dolls which include multiple motors facilitating the movement of multiple body parts, while imparting a more life-like movement pattern and appearance to the figure, tend to be extremely costly due to the large number of motors included in the device, and hence, more prone to failure since the failure of even a single motor may compromise the functionality of the entire device

[0005] It would be desirable to provide an animation device which is capable of providing movement and motion in various directions for the head, mouth, arms and body of a toy; yet, the animation device must be inexpensive to produce, reliable, and have a limited amount of expensive components. In this regard, it would be advantageous to provide a reliable animation device capable of producing numerous motions while utilizing minimum number of electrical motors.

SUMMARY OF THE INVENTION

[0006] The present invention addresses these and other deficiencies of animated figures, soft toy animals, and dolls currently available to consumers by providing an animation device for imparting to a toy such as a doll or a soft toy animal, realistic life-like head, mouth, arm and body movements.

[0007] An aspect of the present invention is to provide a multitude of animation features, such as head, mouth, arms and body movement of a figure, in a reliable package, while at the same time utilizing a minimum amount of expensive components. To accomplish this task, a first component referred to as a head and mouth animation device is provided with a single motor to generate head and mouth movement. Moreover, a second component referred to as a lower drive unit is provided with a single motor to provide arms and body movement. By minimizing the amount of motors on the

animation device, and yet providing numerous degrees of freedom, production costs can be reduced, allowing the animation device to sold at a reasonable rate. Furthermore, the reliability of the animation device can be improved if fewer electric motors are utilized.

[0008] The present invention overcomes the aforementioned disadvantages by providing at least six different types of body movements for a figure, while utilizing only two inexpensive electrical motors. Movements derived from the head and mouth animation device include movement of: (1) a lower jaw of the figure between open and closed mouth positions; (2) tilting the head of a figure forward or backward; and (3) tilting of the head of a figure to the right or to the left. Movements derived from the lower drive unit include: (4) twisting or rotational movement of an upper assembly or body portion about a vertical axis, (5) movement of arms of the figure in a motion which resembles the motion of human arms when the human is running; and (6) movement of a midbody perimeter hoop in a twisting, up and down, gyrating and erratic jerking motion.

[0009] In particular, an exemplary embodiment of the present invention is an animation device for generating movements of limbs and extremities of an animated figure. The animated device includes a single motor coupled to a gear box assembly. A first drive axle coupled to the gear box assembly is provided, wherein the first drive axle is rotatable about a first axis. A second drive axle is also coupled to the gear box assembly, in which the second drive axle is rotatable about a second axis and oriented substantially perpendicular to the first drive axle. A gear train assembly is coupled to a lower end of the second drive axle and an output drive shaft is coupled to the gear drain assembly. Moreover, the output drive shaft is rotatable about a third axis oriented parallel to and offset from the second axis. A left cam is coupled to a left end of the first drive axle and a right cam is coupled to a right end of the first drive axle. Both the left and right cams are configured for radial movement about the first drive axle when the motor is activated. Furthermore, a middle cam is coupled to a middle section of the second drive axle and configured for radial movement about the second drive axle when the motor is activated. And, a lower cam is coupled to the output drive shaft, wherein the

lower cam is configured for radial movement about the output drive shaft when the motor is activated.

[0010] According to another aspect of the present invention, the left cam is cooperatively attached to a left arm movement link cooperatively attached to a left arm assembly, wherein motion is induced in the left arm assembly when the motor is activated. Furthermore, the right cam is cooperatively attached to a right arm movement drive link cooperatively attached a right arm assembly, wherein motion is induced in the right arm assembly when the motor is activated.

[0011] According to another aspect of the present invention, a left arm assembly is provided containing a left shoulder axle having a left inboard retaining boss rotatably attached to a left shoulder bearing journal fixed to the animation device to form a left shoulder joint. A left input cam is coupled to a center section of the left shoulder axle, the left input cam swivel is attached to an upper end of the left arm movement link, and a left output cam is coupled to an outboard end of the left shoulder axle. Moreover, the left output and input cams are configured for simultaneous radial movement about the left shoulder axle, a left arm link swivel is attached to the left output cam, and a left forearm cam having a left forearm follower is integrally formed with the left forearm cam. Furthermore, motion is induced in the left forearm follower when the motor is activated.

[0012] In yet another aspect of the present invention, a right arm assembly is provided containing a right shoulder axle having a right inboard retaining boss rotatably attached to a right shoulder bearing journal fixed to the animation device forming a right shoulder joint. A right input cam is coupled to a center section of the right shoulder axle, the right input cam is swivel attached to an upper end of the right arm movement link, and right output cam is coupled to an outboard end of the right shoulder axle. The right output and input cams are configured for simultaneous radial movement about the right shoulder axle, a right arm link is swivel attached to the right output cam, and a right forearm cam having a right forearm follower is integrally formed with the right forearm cam, wherein motion is induced in the right forearm follower when the motor is activated.

[0013] Further aspects of the invention include a hoop movement cam cooperatively attached to an inner hub connected to a midbody perimeter outer frame by a plurality of spokes. The hoop movement cam is able to induce at least one of gyrating, jerking, tilting, up and down, and rotating movement of the midbody perimeter outer frame when the motor is activated.

[0014] According to a still a further aspect of the present invention, the lower cam is cooperatively attached to an arcuate shaped lower cam receiving slot formed in a surface of a housing assembly, in which the receiving slot induces an upper assembly of the animation device to rotate in a back and forth motion when the fourth cam is radially rotated about the third axis when the motor is activated.

[0015] In another embodiment of the present invention, an animation device is provided for generating movement of limbs and extremities of the animated figure. The animation device includes a lower motion unit, an upper motion unit, and a chassis adapted to internally house and support the lower and upper motion units. The lower motion unit includes a first motor coupled to a gear box assembly, a first drive axle coupled to the gear box assembly, wherein the first drive axle is rotatable about a first axis. A second drive axle is also coupled to the gear box assembly, in which the second drive axle is rotatable about a second axis, and the second drive axle is oriented substantially perpendicular to the first drive axle. Moreover, a gear train assembly is coupled to a lower end of the second drive axle with an output drive shaft coupled to the gear train assembly, such that the output drive shaft is rotatable about a third axis oriented parallel to and offset from the second axis. Further, a left cam is coupled to a left end of the first drive axle and a right cam is coupled to a right end of the first drive axle. Both the left and right cam are configured for simultaneous radial movement about the first drive axle when the first motor is activated. Also, a middle cam is coupled to a middle section of the second drive axle, wherein the middle cam is configured for radial movement about the second drive axle when the first motor is activated. And, a lower cam is coupled to the gear train assembly, wherein the lower cam is configured for radial movement about the third axis when driven by the first motor. Furthermore, the upper

motion unit includes, an upper cam cooperatively engaged to a jaw, wherein the upper cam is configured for linear movement along a fourth axis concurrently with pivotal movement about fifth and six axes which are both normal to the fourth axis and to each other. Moreover, a motor is coupled to the upper cam and operative to facilitate the movement thereof along the fourth axis concurrently with movement about the fifth and sixth axes.

[0016] In another aspect of the present invention, the upper cam cooperatively engages to the jaw such that movement of the upper cam about the fourth axis facilitates movement of the jaw between open and closed positions. With this aspect, movement of the upper cam about the fifth axis facilitates movement of a head portion in an arcuate path between left and right positions, and movement of the upper cam about the sixth axis facilitates movement of the head in an arcuate path between forward and backward positions.

[0017] Additionally, other aspects of the present invention include the left and right cam each having an arm movement link cooperatively connected to a respective left and right moveable arm to produce a back and forth swinging motion in the moveable arms. In yet another aspect of the present invention, the middle cam is cooperatively connected to an inner hub of a midbody perimeter hoop to produce a twisting, up and down, gyrating and erratic jerking motion of the midbody perimeter hoop.

[0018] In yet a further aspect of the present invention, a center axis of the midbody perimeter hoop is offset from the second axis, and furthermore, the center axis is tilted with respect the second axis. According to another aspect of the present invention, the lower motion unit, upper motion unit, and a chassis comprise an upper assembly of the animation device. Furthermore, a lower assembly includes a housing having a planar base and is covered by a revolving plate interconnected to a bottom side of the upper assembly.

[0019] Another aspect of the present invention provides a lower cam engaged to an arcuate shaped receiving slot integrally formed within the planar base to produce a back and forth rotational motion of the upper assembly about the second axis.

[0020] According to still a further embodiment of the present invention, an animation device is provided having a body composed of an upper assembly, midbody section, and lower assembly. The upper assembly has a moveable head with a movable lower jaw hinged to the head, and pair of moveable arms cooperatively attached to a respective pair of shoulders on the upper assembly. The upper assembly further includes an upper drive unit disposed within the upper assembly having a first electric motor coupled to a first gear train, the first gear train is coupled to a first at least one cam and follower set, with the first at least one cam and follower set cooperatively connected to the moveable head and the lower jaw to produce an up and down jaw movement and tilting of the head in a back and forth direction and side to side direction. Also, a lower drive unit is disposed within the upper assembly having a second electric motor coupled to a second gear train, with a second gear train coupled to a second at least one cam and follower set cooperatively connected to the pair of moveable arms to produce a back and forth swinging movement in the pair of moveable arms. A midbody section is rigidly connected to the upper assembly and rotatably connected to the lower assembly by a revolving plate, wherein the midbody has a midbody perimeter hoop defining an extremity of the body. The midbody section further includes a third at least one cam and follower set coupled to the first gear train, where the third at least one cam and follower set is cooperatively connected to the midbody perimeter hoop to produce at least one of a twisting, up and down, gyrating and erratic jerking motion of the midbody section. And the aforementioned embodiment further includes a lower assembly having a base adapted to support the body to a substantially horizontal planar surface. The lower assembly includes a third gear train disposed within coupled to a driveshaft coupled to the first gear train, and a fourth at least one cam and follower set cooperatively transferring motion to the revolving plate to produce a back and forth rotation of the upper assembly and the midbody about an axis defined by the driveshaft.

[0021] According to another aspect of the present invention, the animation device includes a programmable central processing unit for (1) programming specific dance routines dictated by motions produced by the animation device, (2) specific audible

sounds, and (3) operational modes of which the animation device performs to accordingly.

[0022] Another aspect of the present invention includes a motion detector which activates the animation device when motion is detected by the detector. A still further aspect of the invention is an infrared transmitting and receiving feature allowing the animation device to send and receive data over a wireless infrared connection. Other aspects of the invention include a body adapted to be exteriorly attached to the animation device. Also, an aspect of the present invention, is that the body is a Christmas tree figure.

[0023] Another aspect of the present invention includes a clutch release mechanism integrated into the driveshaft between the second gear train and the third gear train to prevent damage to the animation device when moving parts of the animated device are inappropriately forced to be moved by a user of the animated device.

[0024] Another embodiment of the present invention includes an animation device including a first motor coupled to a first gear train having a first and second output shaft in which the output shafts are configured perpendicular to each other. A left cam is radially connected to a left end of the first output shaft wherein the left cam drives a left follower to induce motion in a left arm assembly. A right cam is radially connected to a right end of the first output shaft so that the right cam drives a right follower to induce motion in a right arm assembly. And a middle cam is radially connected to the output shaft so that the middle cam drives a middle follower to induce motion in a midbody perimeter hoop.

[0024] According to another aspect of the present invention, a first input shaft is coupled to a center axis of the middle cam on one end and coupled to a second gear train on the other end. The second gear train has a third output shaft and a lower cam radially connected to the third output shaft. Moreover, the lower cam is interconnected with a lower cam receiving slot for inducing a rotational motion in an upper assembly of said animation device.

[0025] And yet another aspect of the present invention includes the animation device being composed of an upper assembly, midbody section , and lower assembly, wherein th first motor, first gear train, left cam, left follower, right cam, and right follower are contained within the upper assembly; and wherein the middle cam, the middle follower, and midbody perimeter hoop are exteriorly located proximate the midbody section. Another aspect of the present invention include the second gear train, third output shaft, lower cam, and lower cam receiving slot being contained within the lower assembly.

[0026] And yet still, another embodiment of the animation device is provided which includes an upper assembly rotatably interconnected to a lower assembly by a midbody section. The upper section includes a first motor coupled to a first gear train having a first and second output shaft wherein the output shafts are configured perpendicular to each other. A left cam is radially connected to a left end of the first output shaft, wherein the left cam drives a left follower to induce motion in a left arm assembly; and similarly, a right cam is radially connected to a right end of the first output shaft, wherein the right cam drives a right follower to induce motion in a right arm assembly. Also, a middle cam is provided and radially connected to the output shaft. The middle cam drives a middle follower to induce motion in a midbody perimeter hoop. The middle cam, middle cam follower, and midbody perimeter hoop are located within the midbody section between the upper assembly and lower assembly.

[0027] According to another aspect of the present invention, a first input shaft is coupled to a second gear train having a third output shaft, a lower cam is radially connected to the third output shaft, the lower cam is interconnected with a lower cam receiving slot for inducing a rotational motion in the upper assembly of the animation device, wherein the second gear train, lower cam, and cam lower receiving slot are contained within said lower assembly. And yet, another aspect of the present invention includes the middle cam, middle follower and midbody perimeter hoop being mounted to an exterior of the animation device proximate of the midbody section.

[0028] These aforementioned embodiments, aspects and features of the present invention will be discussed in greater detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The present invention is further described in the detailed description that follows, by reference to the noted drawings by way of non-limiting examples of preferred embodiments of the present invention, in which like reference numerals represent similar parts throughout several views of the drawings, and in which:

[0030] Figure 1 shows a front view of an exemplary embodiment of an animation device for head, mouth, arms and body of a toy;

[0031] Figure 2 is a rear view of the exemplary embodiment of the animation device;

[0032] Figure 3 is a left side view of the exemplary embodiment of the animation device;

[0033] Figure 4 is a right side view of the exemplary embodiment of the animation device;

[0034] Figure 5A is a top view of the exemplary embodiment of the animation device;

[0035] Figure 5B is a bottom view of the exemplary embodiment of the animation device;

[0036] Figure 6A is a front upper left side perspective view of an upper assembly of the exemplary embodiment of the animation device;

[0037] Figure 6B is a front upper left side perspective view of a lower assembly of the exemplary embodiment of the animation device;

[0038] Figure 7A is a rear upper left side perspective view of the upper assembly of the exemplary embodiment of the animation device;

[0039] Figure 7B is a rear upper left side perspective view of the lower assembly of the exemplary embodiment of the animation device;

[0040] Figure 8A is a rear lower right side perspective view of the upper assembly of the exemplary embodiment of the animation device;

[0041] Figure 8B is a rear lower right side perspective view of the lower assembly of the exemplary embodiment of the animation device;

[0042] Figure 9 is a second exemplary embodiment of the animation device with a Christmas tree exterior body illustrating the animation device in hidden lines;

[0043] Figure 10 is the second exemplary embodiment of the animation device with the Christmas tree exterior body;

[0044] Figure 11 is an exploded view of the upper assembly of the exemplary animation device from a front upper left side perspective;

[0045] Figure 12 is an exploded view of the upper assembly of the exemplary animation device from a rear upper right side perspective;

[0046] Figures 13A & 13B are exploded views of a lower drive unit;

[0047] Figures 14A & 14B are exploded views of an arm assembly of the exemplary animation device;

[0048] Figure 15 is an exploded view of the lower assembly of the exemplary embodiment of the animation device from an upper front left side perspective;

[0049] Figure 16 is another exploded view of the lower assembly of the exemplary embodiment of the animation device from an upper rear left side perspective;

[0050] Figure 17A is a close-up exploded view of the gear train, revolving plate and clutch release mechanism, and Figure 17B shows the same assembled;

[0051] Figures 18A & 18B are exploded views of the right foot of the exemplary embodiment of the animation device from an upper and lower perspective view.

[0052] Figures 19A & 19B are exploded views of the right foot of the exemplary embodiment of the animation device from an upper and lower perspective view;

[0053] Figure 20 is a front view of the head and mouth animation device utilized in the exemplary embodiment of the animation device;

[0054] Figure 21 is rear view of the head and mouth animation utilized in the exemplary embodiment of the animation device;

[0055] Figure 22 is right side view of the head and mouth device utilized in the exemplary embodiment of the animation device;

[0056] Figure 23 is right side view of the head and mouth animation device utilized in the exemplary embodiment of the animation device;

[0057] Figures 24A & 24B is right side view of the head and mouth device utilized in the exemplary embodiment of the animation device;

[0058] Figure 25 is an exploded view of the head and mouth animation device from a front upper right side perspective;

[0059] Figure 26 is an exploded view of the head and mouth animation device from a back upper right side perspective;

[0060] Figure 27 is an exploded view of the head and mouth animation device from a lower front lower right side perspective;

[0061] Figure 28 is an exploded view of the head and mouth animation device from a back upper right side perspective;

[0062] Figure 29 is another exploded view of the head and mouth animation device from an upper back right side perspective;

[0063] Figure 30 is an exploded view of the head and mouth animation device from an upper back left side perspective; and

[0064] Figure 31 provides a schematic of exemplary control circuitry which may be used to control and coordinate the various movements of the animation device

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0065] The particulars shown herein are by way of example and for purposes of illustrative discussion of the embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the present invention. In this regard, no attempt is made to show structural details of the present invention in more detail than is necessary for the fundamental understanding of the present invention, the

description taken with the drawings making apparent to those skilled in the art how the several forms of the present invention may be embodied in practice.

A. General Description of Exemplary Embodiment of Animation Device

[0066] Referring now to the drawings wherein the showings are for purposes of illustrating a preferred embodiment of the present invention only, and not for purposes of limiting the same, Figures 1-31 provide various views of animation device 2 constructed in accordance with an exemplary embodiment the present invention. It is contemplated that animation device 2 will be integrated into an animated figure or toy, such as a doll or soft toy animal (see Figures 9 & 10). As will be discussed in more detail below, animated device 2 is specifically adapted to impart to an animated figure (or doll) various head, mouth, arm and body movements which create an animated, life-like effect.

[0067] The animated movements may be performed by animation device 2 may occur simultaneously, or in various sequences, depending on the desired animation effect. The control and coordination of such movement(s) is facilitated by a central processing unit 284 (e.g., a microprocessor) as will also be discussed in more detail later in the specification. Animation device 2 is able to impart the various movements to the animated figure, soft toy animal or doll through the use of only two electric motors. Thus, the animated figure including animation device 2 is considerably more simplified in construction. As a result, animation device 2 will be less costly to manufacture than those known in the prior art, more reliable, while at the same time providing superior animated effects.

[0068] The invention will now be described according to Figures 1-31. Figures 1-4 show a front, rear, left side, and right side view of an exemplary embodiment of an animation device 2 for head, mouth, arms and body of a toy. Also provided is Figure 5A which depicts a top view and Figure 5B which depicts a bottom view of animation device 2. Animation device 2 comprises several main components, each of which will be described in detail below.

[0069] Figures 6A and 6B is a front upper left side perspective view of the exemplary embodiment of the animation device separated into two main assemblies. Figure 6A depicts an upper assembly 4 and Figure 6B depicts a lower assembly 6. Both units are interconnected by simultaneously sliding left connecting box 12 (see also Figure 8A) and right connecting box 14 into left receiving connecting structure 8 and right connecting structure 10, respectively, and then securing the aforementioned features together with fastening hardware via fastening apertures 9.

[0070] Figures 7A and 7B are rear upper left side perspective views of upper assembly 4 and lower assembly 6 of the exemplary embodiment of animation device 2. Figures 8A and 8B are rear lower right side rear perspective views of upper assembly 4 and lower assembly 6 of animation device 2. From this vantage point, left connecting box 12 and right connecting box 14 are clearly visible.

[0071] Figures 9 and 10 depict an exemplary embodiment of the invention with a Christmas tree exterior body 16 attached thereto and integrated with animation device 2 (shown in hidden lines). As previously mentioned, the present invention may be utilized with a variety of different types of animated figures. For instance, the exterior body may represent an animal such as a dancing bear or gorilla. Or the exterior body may be in the form of a human being, such as a Sumo wrestler, dancing Luau lady, a large jolly man, or perhaps an animated cartoon character. As can be seen from the aforementioned suggestions, the animated figure may take the form of a wide variety of shapes, figures, or objects ranging from realistic depictions to make believe cartoon characters.

B. Description of Exemplary Embodiment of Upper Assembly

[0072] Figure 11 is a front upper left side exploded view of upper assembly 4 of the exemplary animation device 2, and, Figure 12 is a rear upper right side view of upper assembly 4. Upper assembly 4 is comprised of at least several main components: a main structural chassis 3, a lower drive unit 24, a left arm assembly 28 and right arm assembly 30, head and mouth animation device 26, and a midbody perimeter hoop 32. Upper assembly 4 is structurally held together by main structural chassis 3 having a clamshell

type design. Chassis 3 includes two main components, front chest 18 and back chest 20 which may be secured together with a variety of known fastening techniques. Chassis 3 is adapted to enclose and support various internal components including head and mouth animation device 26, lower drive unit 24, and speaker 42. The head and mouth device 26 is rotatably fastened to chassis 3 with two vertical mounting brackets 253 which have swivel journals 255 that receive swivel bosses 251. Chassis 3 is also adapted to cooperatively engage with left and right arm assemblies 28, 30, and fully enclose arm movement input links 51. Also shown is midbody perimeter hoop 32 which includes spokes 38 and inner hub 36. Hoop movement cam 40 is utilized to induce motion into perimeter hoop 32, while hoop strings 39 are tied to outer frame 34 of the perimeter hoop 32 to constrain movement. It is also shown that hoop string 39 is tied to string fasteners 41 which snap fit into the bottom end of the front chest 18 and back chest 20. The function of perimeter hoop 32 will be elaborated in further detail later in the specification. Moreover, Figure 12 clearly illustrates back chest cover 22, which attaches to back chest 20.

C. Description of Exemplary Embodiment of Lower Drive Unit

[0073] Figures 13A & 13B are exploded views of lower drive unit 24 which is used to produce motion in arm assemblies 28, 30, midbody perimeter hoop 32, and upper assembly 4. Lower drive unit 24 has a drive unit base 78 and a drive unit cover 80, which when fastened together, have a clamshell design forming an enclosure for lower drive unit 24 components. Both base 78 and cover 80 are adapted to be fastened to front and back chest 18, 20. Base 76 provides a cylindrical receiving bracket 110 for a first reversible electric motor 76. Lower drive unit 24 is configured to produce rotation about a first axle 106 positioned along a first axis 107, while simultaneously producing rotation about a second axle 108 positioned along a second axis 109, where the first and second axes 107, 109 are oriented substantially normal with respect to one another.

[0074] This configuration is accomplished by coupling first electric motor 76, having a first motor pulley 75, to a first drive pulley 80 via a first drive belt 86. First

drive pulley 80 is coupled to one end of a pulley axle 90. A first pinion gear 92 is axially coupled to an opposing end region of pulley axle 90 and the other end of pulley axle 90 is rotatably disposed within a retaining boss. First pinion gear 92 is arranged to intermesh with and drive a first spur gear 94 which intermeshes with and drives a second pinion gear 95 axially coupled contiguous to first spur gear 94. Second pinion gear 95 is arranged to intermesh with and drive a second spur gear 96 which is fit to a second spur gear shaft 97 via a spur/pinion gear clutch 100. Furthermore, second spur gear 96 is axially coupled contiguous to a third pinion gear 98 and also subject to spur/pinion gear clutch 100. Third pinion gear 98 meshes with and drives a first axle drive spur gear 102 coupled to a first axle 106. First axle 106 is disposed within axle journals on both base 78 and cover 80 so as to position first axle 106 about a substantially horizontally first axis 107.

[0075] Mounted on opposing ends of first axle 106 is a left cam 82 and right cam 84, which when driven by first electric motor 76, produce simultaneous radial motion about first axle 106. As observed from Figures 13A & 13B, left and right cams 82, 84 are configured external to drive unit 24. Disposed on the exterior faces of left and right cams 82, 84 are cam linkage connectors 81 which are adapted to rotatably cooperate with arm movement links 51 (see Figures 11 & 12). Also note that left cam 82 cam linkage connector 81 is preferably not aligned with right cam linkage connector 81. The function of left and right cams 82, 84 is to drive left and right arm assemblies 28, 30, details of which will be discussed in further detail later in the specification. Furthermore, to produce body movement in upper assembly 4, a second axle drive gear 104 is provided on an end of a second axle 108 oriented about a second axis 109 which is configured substantially perpendicular to first axle 106. Second axle drive gear 104 is configured to be normally oriented to first axle drive gear 102 so that it intermeshes with and is driven by first axle drive gear 102. When second axle drive gear 104 is driven by first electric motor 76, second axle 108 is rotated about the second axis 109. Second axle 108 is coupled to lower body parts of animation device 2 to produce movement thereof, effects of which will be elaborated in later in the specification.

D. Description of Exemplary Embodiment of Arm Assemblies

[0076] Figures 14A & 14B are exploded views of an arm assembly 44 of the exemplary animation device 2. Motion is induced into arm assembly 44 from lower drive unit 24, via rotation of left cam and right cams 82, 84, which in turn generate rotational movement of arm movement links 51 which are cooperatively hinged to input cam 50, so that input cam 50 is rotatably driven. Input cam 50 is axially centered and coupled to a center section of shoulder axle 46 which is rotatably fixed to one of the left or right shoulder journals 21, 23 integrally formed within back chest 20 (shown in Figure 11). Axle 46 is retained in left and right shoulder bearings 21, 23, journal caps 25 (shown in Figure 11), and by an inboard retaining boss 48 fixed to the inboard distal end of axle 46. Therefore, shoulder bearings 21, 23 act as a fixed hard mount for shoulder axle 46, yet still allowing axle 46 to rotate. Coupled to an exterior distal end of shoulder axle 46 is output cam 52, which is swivel linked to arm link 54 to transfer rotational movement. Arm link 54 is swivel connected to forearm cam 56 which is integrally molded with forearm follower 58. Forearm follower 58 acts as a movable exterior structural portion of arm assembly 44. An embodiment of animation device 2 has a hand piece (not shown) attached to the distal tip of forearm follower.

[0077] The exterior of arm assembly 44 is formed by utilizing a front shoulder clam shell 62 connected to a rear shoulder clam shell 64. Interiorly molder within front and rear shoulder clam shells 62, 64 are input cam journals 66 and output cam journals 68 which are adapted to receive input cam 50 and output cam 52, respectively, and configured to allow cams 50, 52 to freely rotate. From Figures 14A and 14B it is further shown that inner clam shell 70 and outer clam shell 72 are fastened together to form an outer exterior portion of arm assembly 44 which encloses arm link 54 and forearm cam 56. A forearm follower cover 74 is attached to forearm follower 58. The combination of inner and outer arm clamshell 70, 72, forearm cam 56, forearm follower 58, and forearm follower cover 74 provide the structure which defines a swivel elbow joint 53. The joint rotates about an axis which is centered through inner elbow boss 55 and an inner elbow boss receiver (not shown) integrally formed with follower cover 74. The swivel elbow

joint 53 is fastened together axially through elbow joint apertures 57 integrally formed within both arm clamshells 70, 72.

E. Description of Exemplary Embodiment of Lower Assembly

[0078] Figure 15 is an exploded view of lower assembly 6 of the exemplary embodiment of animation device 2 from an front upper left side perspective, and Figure 16 is another exploded view of lower assembly 6 of the exemplary embodiment of animation device 2 from an rear upper left side perspective. Left and right shoes 134, 136 are adapted to support animation device 2 on a substantially horizontal surface. Left shoe 134 includes motion detector 138, power on/off and volume control 142, electrical cord receptacle 144, and mode selection switch 146, the function of these components will be described later in the specification. Lower housing 114 is fastened to shoes 134, 136 by inserting at least one fastening dowel 131 (see Figure 16, limited view) into shoe fastening bosses 133. Upper housing 112 is fastened to lower housing 114 to form an enclosure 117 for a battery case 115. Battery case 115 may be installed and removed from enclosure 117 by securing enclosure 117 opened/closed with release fastener 116.

[0079] Besides providing an enclosure for battery case 115, upper housing 112 has other features which are herein next described. A collar 18 is connected to the top surface of planar base 141 wherein the top surface acts as the a top for enclosure 117. Integrally molded into planar base 141 is arcuate shaped lower cam receiving slot 140 which receives lower cam 124. Also, integrally molded to the exterior surface of collar 18 are a plurality of waist roller receivers 122 which are each adapted to receive a waste roller 120. As further shown in Figures 15 & 16, a revolving plate 128 is adapted to sit on top of the plurality of rollers forming a second enclosure 119 of which a gear train 126, gear train box 164, and gear train cover 162 are located. Further description of gear train 126 will be provided in the following section. It is noted that gear train cover 162 has attached to its underside a central cylindrical mount 125 centered about second axis 109 for the purpose of aligning a third axle 148 of gear train 126 with second axis 109 defined by axle 108 (see Figures 13A & 13B) and for pivotably/rotatably attaching gear

train 126 to a central receiving boss 143 integrally formed to the top surface of planar base 141, and centered about second axis 109. When rotational movement is imparted on third axle 148, which is actually just an extension of second axle 108 separated by a clutch release mechanism 130, lower cam 124 is rotated by fourth axle 158 (see Figure 17). The lower cam retainment boss 123 tracks the arcuate shaped lower cam receiving slot 140, and as a result, a rotational movement about second axis 109 is induced into revolving plate 128 since upper housing 112 is rigidly mounted to left and right shoes 134, 136 which are not intended to move. Furthermore, since upper assembly 4 is rigidly mounted to revolving plate 128, upper assembly 4 will also rotate in unison with revolving plate 4 when third axle 148 is driven by first electric motor 76. Also shown in Figures 15 and 16 is waist switch arm 111 which is driven from third axle 148 and waist movement positioning switch 113 attached to the distal end of switch arm 111. This feature allows animation device 2 to detect the amount of rotation that revolving plate 128 and upper assembly 4 undergoes. Sensors may be positioned inside housing collar 118 which send signals to central processing unit 284, which in turn, utilizes the positioning data to control motion routines.

[0080] Figure 17 is a close-up exploded view of lower cam 124, gear train assembly 126, revolving plate 128 and clutch release mechanism 130. Gear train assembly 126 includes third axle 148 which is aligned along second axis 109, wherein the second axis 109 is oriented perpendicular to gear train cover 162. Third axle 148 has an upper end which is received through plate center axial receiving bore 129 of revolving plate 128. The lower end of third axle 148 projects through an aperture gear train cover 162 such that the end may be connected to lower cam 124. A fourth pinion gear 150 is coupled to third axle 148 proximate just above gear train cover 162 about second axis 109. Fourth pinion gear 150 intermeshes with and drives third spur gear 152. Axially coupled and contiguous to third spur gear 152 is a fifth pinion gear 154 located above third spur gear 152 which intermeshes with and drives a fourth spur gear 156. Axially coupled to and contiguous to fourth spur gear 156 is a sixth pinion gear (not shown) below fourth spur gear 156. Sixth pinion gear intermeshes with and drives third drive

gear 160 which is coupled to a fourth axle 158. Fourth axle 158 is oriented along a third axis 149 which is that offset from and parallel to the second axis 109. Fourth axle 158 is then connected to lower cam 124 which produces radial motion about the third axis.

[0081] Figure 17 also illustrates clutch release mechanism 130 which includes engagement spring 170 and engagement ring 172 which act to maintain pressure on upper clutch coupler 168 so that it stays engaged with lower clutch coupler 166. It is noted that clutch coupler 168 receives the lower end of second axle 108 (see Figures 13A & 13B) which is oriented along second axis 109. A lower clutch receiving boss 165 on lower clutch coupler 166 is received through plate center axial receiving bore 129 of revolving plate 128. Receiving boss 165 on lower clutch coupler 166 is fit to the upper end of third axle 148. As a result, an axial drive line is established between second axle 108 and third axle 148, both of which are centered about and rotate about the second axis 109. The function of clutch release mechanism 130 is provided to ensure that damage does not result to lower drive unit 24 gears or gear train assembly 126 gears, or any other drive train components of animation device 2. In particular, clutch release mechanism 130 releases lower drive unit 24 from being bound to gear train assembly 126 when arm assemblies 28, 30, or body portions of lower assembly are inadvertently (or perhaps even purposely) moved by one handling animation device 2

[0082] Figures 18A & 18B are exploded views of a right foot 136 of the exemplary embodiment of the animation device 2. Right shoe 136 includes upper right shoe body 174, upper right shoe toe 175, and right shoe sole 176. Battery enclosure 180 is integrally formed within right shoe sole 176 and covered by removable battery door 178. Upper right shoe body 174 may be disposed with at least one shoe fastening boss 133 which accepts mounting dowel 131 (see Figure 16) which is attached to the bottom of lower housing 114.

[0083] Figures 19A & 19B are exploded views of a left foot 138 of the exemplary embodiment of the animation device 2. Left shoe 138 includes upper left shoe body 182, upper left shoe toe 184, and left shoe sole 186. Printed circuit board 186, of which power on/off and volume control 142, mode selection switch 146, and electrical cord receptacle

144 are attached, is adapted to be integrated within and attached to left foot 138. Also, note motion detector 138 is mounted in upper left shoe toe 184. Upper left shoe body 174 may be disposed with at least one shoe fastening boss 133 which accepts a mounting dowel 131 (see Figure 16) which is attached to the bottom of lower housing 114.

F. Description of Exemplary Embodiment of Head and Mouth Animation Device

[0084] The following section of the specification discusses head and mouth animation device 26, which is utilized in the exemplary embodiment of the animation device. A similar embodiment of the head and mouth animation device 26 has been disclosed and discussed in U.S. Application 10/127,241, filed on April 22, 2002, entitled "Animation Device for Head and Mouth of a Toy", the content of which is expressly incorporated by reference herein in its entirety.

[0085] Figures 20-23 illustrate a front view, rear view, right side view, and left side view of the head and mouth animation device 26 utilized in the exemplary embodiment of the animation device 2. Further provided are Figures 24A & 24B are provided which are top and bottom views of head and mouth animation device 26. Moreover, numerous exploded views of animation device 26 are provided including Figure 25 which is a front upper right side perspective; Figure 26 being an upper back right side perspective; Figure 27 being a front lower right side perspective; Figure 28 being an upper back right side perspective; Figure 29 which is a back upper right side perspective; and Figure 30 being a back upper left side perspective view. The exemplary embodiment of head and mouth animation device 26, shown in the aforementioned Figures 20-30, includes several main components, each of which will be described in detail below.

[0086] As shown in Figures 25-30, head and mouth animation device 26 includes a second reversible electric motor 196 attached to a motor mount plate 198 via a second cylindrical receiving bracket 198. Disposed in an approximate center of motor mount plate 198 is a circularly configured opening 199. Also disposed within the motor mount plate 198 is a pin aperture 201. The use of the opening 199 and pin aperture 201 will be

discussed later in the specification. A second motor pulley 202 is coupled to the drive shaft of second reversible electric motor 196. Second motor pulley 202 is rotatably coupled to a second drive pulley 204 via a second drive belt 203 extending therebetween wherein.

[0087] Contiguously attached to and extending axially from second motor pulley 202 is a sixth pinion gear 206. The second motor pulley 202 and sixth pinion gear 206 collectively define an axially extending central aperture which slidably accommodates an elongate, cylindrically configured first pin 262 which is advanced into and through such central aperture. It is further noted that since both second motor pulley 202 and sixth pinion gear 206 are contiguously coupled together, they rotate in unison as one unit, however, they are still able to freely spin as one unit about first pin 262.

[0088] Next, it is noted that sixth pinion gear 206 is intermeshed and drives a fifth spur gear 212. Contiguously attached to and extending axially from fifth spur gear 212 is a seventh pinion gear 210. As a result of fifth spur gear 212 and seventh pinion gear 210 being coupled together, they collectively define a continuous aperture extending axially therethrough. This aperture has a circular cross-sectional configuration, and is sized to slidably accommodate an elongate second pin 264 which is also slidably advanced through bracket pin aperture 201 of the motor plate 198, with bracket pin aperture 201 having a diameter which closely exceeds the diagonal width of the second pin 264, thus allowing second pin 264 to be rotatable therein. It is further noted that since both fifth spur gear 212 and seventh pinion gear 210 are contiguously coupled together, they rotate in unison as one unit, however, they are still able to freely spin as one unit about second pin 262.

[0089] Furthermore, seventh pinion gear 210 is intermeshed with and drives a sixth spur gear 208, which like the second drive pulley 204 and sixth pinion gear 206, is rotatably mounted to first pin 262. Contiguously attached to and extending axially from the side sixth spur gear 208 is an inner cam 214 and an eighth pinion gear 218. Eighth pinion gear 218 is rotatably coupled to first pin 262 which extends through circular configured opening 199 within the motor mount plate 198 (see Figure 26). Thus, is noted

that eighth pinion gear 218 is advanced through circular configured opening 199 within the motor mount plate 198. It is further noted that since sixth spur gear 208 and eighth pinion gear 218 are contiguously coupled together, they rotate in unison as one unit, however, they are still able to freely spin as one unit about second pin 262.

[0090] Furthermore, as best seen in Figures 28-30, also contiguously attached to the side of the six spur gear 208 is inner cam 214 which has eighth pinion gear 218 positioned within, however, not concentrically about the axis defined by first pin 262. Rather, it is noted that inner cam 214 is radially offset from the axis defined by first pin 262. As a result, the center axis of cam 214 is also offset from the center axis of eighth pinion gear 218 which is also defined by first pin 264.

[0091] Next, it can be seen that inner cam follower 228 is positioned between six spur gear 208 and the motor mount plate 198 (see Figure 27) such that inner cam 214 is advanced into and slidably movable within inner cam receiving slot 216 which is attached to the lower end of cam follower 228, the function of which will be detailed later in the specification.

[0092] In regard to functionality, the activation of second electric motor 196 facilitates rotation in second drive pulley 204, which in turn facilitates rotation of sixth pinion gear 206, and which in turn facilitates concurrent rotation of fifth spur gear 212. The rotation of fifth spur gear 212 facilitates rotation of seventh pinion gear 210, which facilitates rotation of six spur gear 208. The rotation of six spur gear 208 facilitates concurrent rotation of both eighth pinion gear 218 and inner cam 214 which are attached thereto. The eighth pinion gear 218 rotates within the opening 199 of the motor mount plate 198, with the inner cam 214 rotating within inner cam receiving slot 216 of inner cam follower 228. Due to inner cam 214 being radially offset from the axis of the six spur gear 208, the rotation of inner cam 214 within inner cam receiving slot 216 facilitates a reciprocal upward and downward vertical movement of the inner cam follower 228. Such reciprocal movement of inner cam follower 228, in turn, results in reciprocal upward and downward pivotal movement of lower jaw plate 188.

[0093] As indicated above, it is contemplated that head and mouth animation

device 26 of the present invention will be integrated into an animated figure such as a doll or a soft toy animal. In this application, the lower jaw plate 188 will be disposed within the doll or soft toy animal head and cooperatively engaged to a moveable lower jaw thereof. The opposed ends of jaw tube 192 are pivotally connected to jaw connecting pins 189 fixed on left side vertical support member 244 and right side vertical support member 246 (see Figure 25). The upward vertical movement of inner cam follower 228, as a result of the rotation of inner cam 214, facilitates downward pivotal movement of the lower jaw plate 188, and hence the movement of the animated doll mouth to an “open mouth” position. Conversely, the downward movement of inner cam follower as a result of the rotation of inner cam 214 results in upward pivotal movement of the lower jaw plate 188, and hence, movement of the animated doll mouth to a “closed mouth” position.

[0094] As further seen in Figures 25-30, head and mouth animation device 26 also includes a seventh spur gear 220 which is rotatably mounted to second pin 264. Contiguously attached to and extending axially from a side seventh spur gear 220 is a cylindrically configured cam receiving boss 222 having a diameter which is substantially less than that of seventh spur gear 220. It is noted that receiving boss 222 is radially centered about an axis defined by second pin 264. Also contiguously attached to and extending from the same side of seventh spur gear 220 is annular outer cam 224. However, annular outer cam 224 is radially offset such that receiving boss 222 does not extend axially through the center of annular outer cam 224, but rather is offset toward one side thereof. Eighth pinion gear 218 is intermeshed and drives with the seventh spur gear 220 such that the rotation of eighth pinion gear 218 will facilitate concurrent rotation of seventh spur gear 220. The rotation of seventh spur gear 220 facilitates the rotation of annular outer cam 224 due to the coupling of annular outer cam 224 to seventh spur gear 220.

[0095] Operatively coupled to annular outer cam 224 is outer cam follower 226 having a circularly configured primary opening 227 and a smaller, circularly configured secondary opening 229. Due to annular outer cam 224 being offset from the axis defined by second pin 264 and of which seventh spur gear 220 is centered, the rotation of the

seventh spur gear 220 facilitates a back and forth reciprocal movement of outer cam follower 226 which induces motion in the head and mouth animation device which is described in more detail below.

[0096] The aforementioned drive train components are disposed between a front inner casing 234 and a rear inner casing 236 of the head and mouth animation device 26. Disposed in the approximate center of the front inner casing 234 is inner casing boss 238 having an aperture extending axially therethrough which is sized and configured to receive and rotatably support a forward end of first pin 262. Also disposed within the front inner casing 234 is front inner casing receiving aperture 239 which is laterally offset from inner casing boss 238 and is configured to receive and rotatably support the forward end of first pin 236. Similarly, disposed within the approximate center of the rear inner casing 264 is rear inner casing boss 237 having an aperture extending axially therethrough which is sized to receive and rotatably support a rear end of the first pin 262. Also disposed within the rear inner casing 264 is rear inner casing pin receiving aperture 240 which is sized and configured to receive and rotatably support the second pin 264. As will be discussed in more detail below, the second pin 264 is sized such that it is advanced through rear inner casing pin receiving aperture 240. Next, it is observed that left side vertical support member 244 and right side vertical support member 246 are clamshelled together and attached to an upper structure 233 which projects upwardly from the front inner casing 234. Fastened to a pair of attaching bosses 245 located on a mid-section of vertical support members 244, 246 are left semi-circular structure 248 and right semi-circular structures 250, each having a respective pair of boss receivers 249 which accept attaching bosses 245. Moreover, integrally formed above the attaching bosses 245 on both left side vertical support member 244 and right side vertical support member 246 are rail receiving members 247 which are adapted to receive rear support member 242 in a slidable manner.

[0097] As seen in Figure 25, attached to the motor mount plate 198 below the inner cam follower 228 is a mouth contact switch 268. The downward movement of the inner cam follower 228 to the closed mouth position will facilitate contact between the

bottom end of the inner cam follower 228 and the mouth contact switch 268 in a manner actuating the mouth contact switch 268. The actuation of the mouth contact switch 268 transmits a signal to the control circuitry 286 (see Figure 31) of the animation device 2 indicative of the downward movement of the inner cam follower 228 to its downward limit, and hence the movement of the lower jaw plate 188 to the full, closed mouth position. Additionally, as seen in Figures 25 & 27, formed on opposite sides of the lower portion of the front inner casing 234 is a left contact switch actuator 270 and a right contact switch actuator 272, the use of which will be discussed in more detail below.

[0098] In the upper motion unit 26, the front and rear inner casings 234, 236 are disposed between and rotatably connected to a front middle casing 252 and a rear middle casing 254. Disposed within the front middle casing 253 is a front casing aperture 260, while disposed within the rear middle casing 254 is a rear casing aperture 258. Also disposed within the rear middle casing 254 in spaced relation to rear casing aperture 258 is a second arcuate receiving slot 256. Additionally, formed on and extending inwardly from the inner surface of the rear middle casing 254 is an elongate, cylindrically configured outer cam receiving boss 274. Further, formed on and extending outwardly from one side wall of the front middle casing 252 is a front contact switch actuator 276 (see Figure 26). Similarly, formed on and extending outwardly from one side wall of the rear middle casing 254 is a rear contact switch actuator 278. The use of the front and rear contact switch actuators 276, 278 will be described in more detail below.

[0099] In the upper motion unit 26, the inner casing boss 238 protruding from the front inner casing 234 is advanced into and rotatably supported within front casing aperture 260. Similarly, rear inner casing boss 237 protruding from the rear inner casing 236 is advanced into and rotatably supported within the aperture 258. The receipt of the bosses 238, 237 into respective ones of the apertures 260, 258 facilitates a rotatable connection of the attached front and rear inner casings 238, 236 to the receptacle collectively defined by the attached front and rear middle casings 252, 254. When such rotatable connection is achieved, the second pin 264, in addition to being extended through rear inner casing pin receiving aperture 240, is also extended through the second

arcuate receiving slot 256, with a portion of the second pin 264 protruding therefrom in which circularly configured exterior cam 280 (see Figures 25 & 26) is coupled, via exterior cam pin receiving aperture 281, to the end portion of second pin 264. Attached to and extending outwardly from exterior cam 280 is a cylindrically configured cam extension 282 which is radially offset from the exterior cam pin receiving aperture 281, and hence, the axis of exterior cam 280.

[0100] When the front and rear inner casings 234, 236 are attached to each other, only a portion of outer cam follower 226 is disposed therebetween, with the segment of outer cam follower 226 defining the secondary opening 229 protruding from the attached front and rear inner casings 234, 236. When front and rear inner casings 234, 236 are rotatably connected to the front and rear middle casings 252, 254 in the above-described manner, cam boss 274 of the rear middle casing 254 is advanced into and through the secondary opening 229 of the outer cam follower 229. As indicated above, annular outer cam 224 may be rotated by the second reversible electric motor 196 to facilitate the movement of outer cam follower 226 to one side or the other. Such movement effectively causes the joined front and rear inner casings 234, 236 (and hence the figure's head) to pivot (rock or tilt) along an arcuate path between right and left positions relative to the joined front and rear middle casings 252, 254. Importantly, the shape of second arcuate receiving slot 256 accommodates the resultant movement of the second pin 264 in an arcuate path relative to the joined front and rear middle casings 252, 254. Thus, the exterior cam 280 which is at the exterior of the joined front and rear middle casings 252, 254 moves with the second pin 264 along its arcuate path, in addition to being rotated thereby. Thus, the rotation of annular outer cam 224 and resultant movement of outer cam follower 226 allows the components of upper motion unit 26 interfaced to and supported by the front and rear inner casings 234, 236 to be moved relative to the front and rear middle casings 252, 254 along an arcuate path between right and left positions.

[0101] Now referring back to Figure 11 & 12, front chest 18 and back chest 20 are adapted to integrally receive and fasten upper motion unit 26 within the cavity defined by the front chest 18 and back chest 20. Formed within the back chest 20 on the

inner surface of the back wall of the rear outer casing 120 is exterior cam follower slot 19. When the front chest 18 and back chest 20 are sandwiched together to unify the main structure of the upper assembly 4, the cam extension 282 of exterior cam 280 is advanced into exterior cam follower slot 19 (see also Figure 2). As indicated above, the second reversible electric motor 196 not only facilitates the rotation of the cam extension 282 about the axis of the second pin 264, but also the movement of the cam extension 282 along the arcuate path defined by the second arcuate receiving slot 256. When the cam extension 282 is advanced into the interior of the exterior cam follower slot 19 in the above-described manner, the rotation and arcuate movement of the exterior cam 280 causes the cam extension 282 to act against the exterior cam follower slot 19 in a manner facilitating the tilting or pivoting movement of the joined front and rear middle casings 252, 2524 (and hence the figure's head) along an arcuate path between forward and backward positions relative to the joined front chest 18 and back chest 20.

G. Description of Exemplary Control Circuitry

[0102] Figure 31 provides a schematic of exemplary control circuitry 286 which may be used to control and coordinate the various movements of the animation device 2 as described above. The control circuitry 286 includes a microprocessor or central processing unit 284 which is programmable, and provided with power from a power source (e.g., batteries or electrical plug) of the animated figure, soft toy animal or doll. Advantageously, the configuration of the animation device 2 imparts various movement capabilities to the head, mouth, arms and body of the animated figure, soft toy animal or doll. The control circuitry 286 may be programmed to facilitate these movements in any combination or sequence. The facilitation of such movements at the same time in a desired sequence achieves a realistic, life-like animated appearance with the animated figure, soft toy animal or doll. Advantageously, these attributes are achieved through the use of only two motors (i.e., first reversible electric motor 76 and second reversible electric motor actuation motor 196). As will be recognized, the relative simplicity of construction of the animation device 2 reduces the costs thereof, and hence the costs of

the animated figure, soft toy animal or doll into which it is incorporated, despite providing an extremely high level of movement/animation capability.

H. Description of Exemplary Motion of Exemplary Embodiment of Animation Device for Head, Mouth, Arms and Body of Toy

[0103] Based on the aforementioned description of the animation device for head, mouth, arms and body of toy, the motion of the exemplary embodiment is now described herewith. Initially it should be noted once again that movement of the present invention is programmable within central processing unit 284. Therefore, the animation device may perform an unlimited number of dancing routines as long as the motion fits within the allowable degrees of freedom provided by animation device 2.

[0104] There are three degrees of freedom with respect to movements derived from the head and mouth animation 26 device of the exemplary embodiment. A first type of movement is from lower jaw 188 between open and closed mouth positions as is illustrated in Figures 2, 3, 22 and 23. Such movement may be coordinated with audio played from speaker 42 to simulate a character speaking or singing. A second type of movement is tilting of inner cam follower 228, rear support member 242, front and rear inner casing 234, 236, left and right side vertical support members 244, 246, left and right semi-circular structures 247, 249, lower jaw plate 188, and upper fixed jaw 194. This produces a simulated back and forth tilting of a head and neck region of the figure. Such back and forth tilting is illustrated in Figures 3, 4, 22, and 23. The third type of motion is includes tilting the previously mentioned components of the head and neck to the right or to the left, which is illustrated in Figures 2, 20, and 21.

[0105] There are also three degrees of freedom with respect to movements derived by lower drive unit 24 of the exemplary embodiment. A first type of movement is twisting or rotational movement of upper assembly 4 about the second axis 109. The second type of movement is up and down, swing back and forth movement of the arm assemblies 28, 30 which resembles the motion of a human's arms when the human is running. This motion is depicted in Figures 2-5 and 9. The third type of motion is

movement of midbody perimeter hoop 32 in a twisting, up and down, gyrating and erratic jerking motion of the midbody perimeter hoop 32.

I. Operation of Exemplary Embodiment of Animation Device for Head, Mouth, Arms and Body of Toy

[0106] Animation device 2 may be powered from a battery source or from an external electrical source which plugs into electrical cord receptacle 144 located in the back of left shoe 134. There are two battery compartments in the animation device 2, battery enclosure 180 located in right shoe 136, and battery case 115 located in lower assembly 6. Battery enclosure 180 holds four 1.5V alkaline “AA” batteries. Battery case 115 holds four 1.5V alkaline “C” batteries.

[0107] To operate animation device 2, the power on/off and volume control 142 should be rotated clockwise to the “On” position to turn animation device 2 on, or counter clockwise to the “Off” position to turn animation device 2 off. Moreover, volume control 142 may be used for adjustment of sound volume from speaker 42.

[0108] Furthermore, animation device has three mode settings which may be set by mode selection switch 146, including “Demonstration Mode”, “Motion-Activation Mode”, and “Button-Activated Mode”.

[0109] For “Demonstration Mode”, mode selection switch 146 is positioned to position “0” and volume control 142 should be turned clockwise towards the “On” position until it clicks on. Then activation button 288 should be pressed (located in the front of the character, see Figure 10). In this mode, the character will sing and dance for about 20 seconds and then stop.

[0110] For the “Motion-Activation Mode”, mode selection switch 146 should be positioned to “1” and volume control 142 should be turned to the “On” position. In this mode, the character will sing and dance for about one minute every time someone passes by, then stop and wait for another person to pass by. The animation device 2 is able to sense motion because a motion detector 138 is installed into the upper left shoe toe 184.

[0111] For the “Button-Activated Mode”, mode selection switch 146 should be

positioned to “2” and the volume control 142 should be turned to the “On” position. In this case, the character will start to sing and dance for about one minute and then stop.

[0112] Additionally, an embodiment of animation device 2 may include features which allows it to communicate with another animated figures or devices. Such technology is provided in U.S. Patent Application No. 10/200,696, filed July 22, 2002, entitled, “Interactive Talking Dolls”, the contents of which are expressly incorporated by reference herein in its entirety. For instance an embodiment may include incorporating within animation device 2 an infrared wireless receiver and transmitter. This feature may be utilized for allowing animation device 2 to send and receive data over a wireless connection. Also, the infrared feature may be utilized to have animation device 2 speak to and move in unison with another similar animated device so as to carry out coordinated movements and simulate conversation between a plurality of animated figures.

[0113] Although the invention has been described with reference to several exemplary embodiments, it is understood that the words that have been used are words of description and illustration, rather than words of limitation. Changes may be made within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the invention in its aspects. Although the invention has been described with reference to particular means, materials and embodiments, the invention is not intended to be limited to the particulars disclosed; rather, the invention extends to all functionally equivalent structures, methods, and uses such are within the scope of the appended claims.

LIST OF REFERENCE NUMERALS

- 2. animation device
- 4. upper assembly
- 6. lower assembly
- 8. left receiving connecting structure
- 9. fastening apertures
- 10. right receiving connecting structure
- 12. left connecting box
- 14. right connecting box
- 16. exemplary Christmas tree exterior body
- 18. front chest
- 20. back chest
- 21. right shoulder bearing
- 22. back chest cover
- 23. left shoulder bearing
- 24. lower drive unit or gear box assembly
- 25. journal caps
- 26. head and mouth animation device
- 28. left arm assembly
- 30. right arm assembly
- 32. midbody perimeter hoop
- 34. outer frame
- 36. inner hub
- 38. spokes
- 39. hoop string
- 40. hoop movement cam or middle cam
- 41. string fasteners
- 42. speaker

Case No.: SMART-084B

- 44. arm assembly
- 46. shoulder axle
- 48. inboard retaining boss
- 50. input cam
- 51. arm movement link
- 52. output cam
- 53. swivel elbow joint
- 54. arm link
- 55. inner elbow boss
- 56. forearm cam
- 57. elbow joint aperture
- 58. forearm follower
- 62. front shoulder clam shell
- 64. rear shoulder clam shell
- 66. input cam journal
- 68. output cam journal
- 70. inner arm clamshell
- 72. outer arm clamshell
- 74. forearm follower cover
- 75. first motor pulley
- 76. first reversible electric motor
- 78. drive unit base
- 80. drive unit cover
- 81. cam linkage connector
- 82. left cam
- 84. right cam
- 86. first drive belt
- 88. first drive pulley
- 90. pulley axle

Case No.: SMART-084B

- 92. first pinion gear
- 94. first spur gear
- 96. second spur gear
- 97. second spur gear shat
- 98. third pinion gear
- 100. spur & pinion clutch
- 102. first axle drive gear
- 104. second axle drive gear
- 106. first axle
- 107. first axis
- 108. second axle
- 109. second axis
- 110. cylindrical receiving bracket
- 111. waist switch
- 112. upper housing
- 113. waist movement switch
- 114. lower housing
- 115. battery case
- 116. release fastener
- 117. first enclosure
- 118. housing collar
- 119. second enclosure
- 120. waist roller
- 122. waist roller receiver
- 123. lower cam retainment boss
- 124. lower cam
- 125. central cylindrical mount
- 126. gear train
- 128. revolving plate

Case No.: SMART-084B

- 129. plate center axial receiving bore
- 130. clutch release mechanism
- 131. fastening dowel
- 132. plate retaining ring
- 133. shoe fastening boss
- 134. left shoe
- 136. right shoe
- 138. motion detector
- 140. arcuate shaped lower cam receiving slot
- 141. planar base
- 142. power on/off and volume control
- 143. central receiving base
- 144. electrical cord receptacle
- 146. mode selection switch
- 148. third axle
- 149. third axis
- 150. fourth pinion gear
- 152. third spur gear
- 154. fifth pinion gear
- 156. fourth spur gear and sixth pinion gear (not shown)
- 158. fourth axle
- 160. third drive gear
- 162. gear train cover
- 164. gear train box
- 165. lower clutch receiving boss
- 166. lower clutch coupler
- 168. upper clutch coupler
- 170. engagement spring
- 172. engagement ring

Case No.: SMART-084B

- 174. upper right shoe body
- 175. upper right shoe toe
- 176. right shoe sole
- 178. battery enclosure door
- 180. battery enclosure
- 182. upper left shoe body
- 184. upper left shoe toe
- 186. printed circuit board
- 188. lower jaw plate
- 189. jaw connecting pins
- 190. jaw support
- 191. jaw receiving slot
- 192. jaw tube
- 194. upper fixed jaw
- 196. second reversible electric motor
- 198. motor mount plate
- 199. circular configured opening
- 200. second cylindrical receiving bracket
- 201. bracket pin aperture
- 202. second motor pulley
- 203. second drive belt.
- 204. second drive pulley
- 206. sixth pinion gear
- 208. sixth spur gear
- 210. seventh pinion gear
- 212. fifth spur gear
- 214. inner cam
- 216. inner receiving slot
- 218. eighth pinion gear

Case No.: SMART-084B

- 220. seventh spur gear
- 222. cam receiving boss
- 224. annular outer cam
- 226. outer cam follower
- 227. primary opening
- 228. inner cam follower
- 229. secondary opening
- 230. inner cam follower receiving slot
- 232. jaw connecting link
- 233. front inner casing upper structure
- 234. front inner casing
- 236. rear inner casing
- 237. rear inner casing boss
- 238. inner casing boss
- 239. front upper casing pin receiving aperture
- 240. rear inner casing pin receiving aperture
- 242. rear support member
- 244. left side vertical support member
- 245. attaching bosses
- 246. right side vertical support member
- 247. rail receivers
- 248. left semi-circular structure
- 250. right semi-circular structure
- 251. swivel boss
- 252. front middle casing
- 253. vertical mounting brackets
- 254. rear middle casing
- 255. swivel boss journal
- 256. second arcuate receiving slot

Case No.: SMART-084B

- 258. rear casing aperture
- 260. front casing aperture
- 262. first pin
- 264. second pin
- 268. mouth contact switch
- 270. left contact switch actuator
- 272. right contact switch actuator
- 274. outer cam receiving boss
- 276. front left contact switch actuator
- 277. front right contact switch actuator
- 278. rear contact switch actuator
- 280. exterior cam
- 281. exterior cam pin receiving aperture
- 282. cylindrically configured cam extension
- 284. central processor unit or microprocessor
- 286. control circuitry
- 288. activation button